Patent Application
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for

LEAK-PROOF DRINKING CONTAINER

Background-Field of the Invention

This invention relates to a closure for a liquid container and is particularly concerned with closures which remain in place while drinking, are leak-proof, easy to clean, and do not contain a valve.

Background-Description of Prior Art

In some prior art arrangements, the closures have an outlet passage containing an opening. Within the outlet passage there is a membrane which is slit creating a valve which can be activated by suction from the user. When suction is applied, the slit forms an opening and provides a flow opening for withdrawal of the contained liquid. The disadvantage of prior art arrangements of this approach is the membrane requires a secondary operation (formation of the slit) during manufacturing. Another disadvantage is the membrane becomes distorted over time and loses its ability to form a leak-proof seal. Other prior art arrangements contain a tube or liquid passage from which the contained liquid is withdrawn by suction from the user. An example of this type of prior art would be U.S. Patent 4,795,052 and U.S. Patent 4,915,250. The disadvantage of prior art arrangements of this approach is the tube or liquid passage is difficult if not impossible to clean and it is a multi-piece structure. Another prior art arrangement is shown in WIPO publication number WO 01/12031 A1

in which Samson discloses a closure with a tubular passage formed by the insertion of a plug into a spout. The disadvantage of this prior art is the closure requires multiple pieces to function and it requires disassembly for cleaning.

Objectives and Advantages

The main objective of the present invention is to provide a closure which overcomes the disadvantages previously stated.

Another objective of the present invention is to provide a closure for a container, specifically designed to handle liquids, that provides a means of communication between the interior and exterior of the container only when withdrawal of the liquid is desired.

It is a further objective of the present invention to provide a closure which does not require a self-sealing slit or any other type of valve, is a simple one-piece structure, and is easy to clean.

Drawing Figures

Fig. 1 is a top view of a closure for a leak-proof drinking container.

Fig. 1A is the cross-sectional view taken as indicated by section line A-A applied to Fig. 1.

Fig. 1A' is the same cross-sectional view as Fig. 1A, showing the container attached to the closure.

Ins A1

Reference Numerals in Drawings

10 Closure
11 Recessed channel
12 Container
13 Outlet passage
14 Fluid exit
15 Fluid entrance

Ins A2

Summary

A closure for use in dispensing a liquid from a container. The closure and container together form an outlet passage opened at both ends. When the container is overturned, the liquid will begin to flow into one

end of the outlet passage. The displacement of liquid from the container will create a partial vacuum in the container. This will prevent the liquid from reaching the other end of the outlet passage, thus it will not leak.

Description-Figs. 1 through 1A'

Referring to the drawings, the leak-proof closure of the present invention is indicated as reference numeral **10**. The closure **10** may be made of materials such as polypropylene, polyethylene, thermoplastic rubbers, or a combination thereof and can be reusable or disposable. The closure **10** is circular in shape, having a substantially planar cover portion and may vary in size depending upon the size of the container **12**. The closure **10** is shown without a vent means. If a vent is used, it will require a vent which opens at a predetermined pressure differential between the interior and exterior of the container **12**. When container **12** is overturned a partial vacuum will be created in the container **12**. The vent must not open as a result of this partial vacuum or liquid can leak from the container **12**. However, when in use, the liquid will be withdrawn from the container **12** creating a greater partial vacuum. The vent must open at this greater partial vacuum. The recessed channel **11** can be part of closure **10**, container **12**, or both. When container **12** and closure **10** are assembled by a friction fit or mating threads, outlet passage **13** is formed. It might be desirable to insert mold or over mold a thermoplastic rubber or other flexible material onto either the closure **10**, the container **12**, or both in the area where outlet passage **13** is formed. This would allow for an improved seal between the closure **10** and the container **12**. The volume of outlet passage **13** should be approximately .060 cubic inches or greater. A volume less than .060 cubic inches would increase the probability of the liquid leaking from the container. The cross-sectional area of outlet passage **13** should be large enough to provide for easy withdrawal of the liquid from the container **12**. The cross-sectional area of outlet passage **13** should be small enough to prevent air bubbles from flowing past the liquid in the outlet passage **13** when container **12** is overturned. It might be desirable to vary the cross-sectional area of the outlet passage **13** making it smaller in some areas and larger in other areas. It might also be desirable for the outlet passage **13** to have a textured surface finish. The outlet passage **13** has two ends, fluid entrance **15** and fluid exit **14**.

The recessed channel **11** is shown in unity, however it might be desirable to have multiple recessed channels which terminate at the same point or in close proximity with one another. The closure **10** is shown without a spout, however it might be desirable have a spout with a through hole which would provide for communication between the end of the spout and fluid exit **14**.

Operation-Figs. 1 through 1A'

Container **12** and closure **10** are molded or manufactured then assembled. Recessed channel **11** is part of container **12**, closure **10**, or both. Outlet passage **13** is formed when container **12** and closure **10** are assembled. When withdrawal of the liquid in the container **12** is desired, external suction is applied at the fluid exit **14** of outlet passage **13**. This allows for delivery of the contained liquid which flows into fluid entrance **15**, through outlet passage **13**, and out of fluid exit **14**. When the suction is released the liquid in outlet passage **13** will return to container **12** due to the partial vacuum in container **12**. When container **12** is overturned, liquid will begin to flow into outlet passage **13** at fluid entrance **15**. The displacement of liquid from the container **12** will create a partial vacuum in container **12**. This partial vacuum will prevent the liquid from reaching fluid exit **14**, thus it will not leak.

Summary, Ramifications, and Scope

The closure of the present invention provides the following advantages over prior embodiments:

1) The closure is leak-proof.
2) It will be possible to withdraw liquid from the container in a normal manner without removing the closure from the container.
3) The closure is a simple structure and may easily be manufactured on conventional plastic forming machines.
4) The closure is a safe device and can be used by small children.
5) The closure does not require a valve.
6) The closure is one piece and it can be easily cleaned.

While embodiments of the invention have been described in detail, it is understood that other modifications and various embodiments thereof may be devised by one skilled in the art without departing from the spirit and the scope of the invention, as defined by the claims.